REMARKS/ARGUMENTS

Claims 1-23 are pending. Claims 1 and 10 have been amended. No new matter has been introduced. Applicants believe the claims comply with 35 U.S.C. § 112.

Claims 20 and 23

Claims 20 and 23 stand rejected under 35 U.S.C. § 102(e) as being anticipated by Chan et al. (US 6,709,930).

Applicants respectfully submit that independent claim 20 is novel and patentable over Chan et al. because, for instance, Chan et al. does not teach or suggest forming a second oxide layer over the first oxide layer of the islands and on a bottom and sidewalls of the trench.

The Examiner alleges that Chan et al. discloses a first oxide layer 30 and a second oxide layer 21. Assuming that the barrier layer 30 in Chan et al. is the first oxide layer, Chan et al. specifically discloses that "an oxide layer 21 is then selectively deposited on the silicon exposed in the bottom of trench 19 rather than on the barrier layer 30" (col. 3, lines 11-13). As shown in Fig. 3D, the oxide layer 21 is deposited on the silicon at the bottom of the trench 19 only, and is not formed on the barrier layer 30 of the islands.

For at least the foregoing reasons, claim 20 and claim 23 depending therefrom are novel and patentable over Chan et al.

Claims 1, 2, 6-12, and 16-19

Claims 1, 2, 6-12, and 16-19 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Chan et al. in view of Jang I et al. (US 5,926,722).

Applicants respectfully assert that independent claim 1 is patentable over Chan et al. and Jang I et al. because, for instance, they do not disclose or suggest forming a trench structure disposed between islands in the semiconductor substrate, the islands having formed thereon the silicon nitride layer and the first oxide layer; forming a second oxide layer on a bottom and sidewalls of the trench and on a surface of the first oxide layer on the islands; removing the first oxide layer and the second oxide layer on the surface of the silicon nitride layer and leaving the silicon nitride layer on the islands; and removing the second oxide layer on the sidewalls of the trench and a portion of the second oxide layer on the bottom of the trench and leaving the silicon nitride layer on the islands.

As discussed above, Chan et al. specifically discloses that "an oxide layer 21 is then selectively deposited on the silicon exposed in the bottom of trench 19 rather than on the barrier layer 30" (col. 3, lines 11-13), so that the oxide layer 21 is deposited on the silicon at the bottom of the trench 19 only and not formed on the barrier layer 30 of the islands. Therefore, Chan et al. clearly teaches away from the claimed feature of forming a second oxide layer on the surface of the first oxide layer on the islands.

The Examiner cites Jang I et al. for allegedly disclosing forming a first oxide layer before forming a trench. Although Jang I et al. also discloses forming an oxide layer 12 on the oxide layer 8 on the islands, there is no motivation to combine Jang I et al. with Chan et al., since Chan et al. specifically teaches away from forming a second oxide layer on the barrier layer 30 on the islands.

In addition, neither Chan et al. nor Jang I et al. discloses or suggests removing the first oxide layer and the second oxide layer on the surface of the silicon nitride layer and leaving the silicon nitride layer on the islands; and removing the second oxide layer on the sidewalls of the trench and a portion of the second oxide layer on the bottom of the trench and leaving the silicon nitride layer on the islands. In Chan et al., the barrier layer 30 and the nitride layer 102 are both removed from the islands (see Fig. 3E). Further, Jang I et al. does not teach removing the second oxide layer 12 on the sidewalls of the trench and a portion of the second oxide layer on the bottom of the trench.

Chan et al. and Jang I et al. discloses different processes and teach away from one another. More specifically, Chan et al. teaches not forming an oxide layer on the barrier layer 30 of the islands and not leaving a nitride layer on the islands. Jang I et al. discloses filling the trench with the second oxide layer 12 and not removing the second oxide layer 12 from the trench. Thus, there is no motivation to combine these very different teachings of the two references.

For at least the foregoing reasons, claim 1 and claims 2 and 6-9 depending therefrom are patentable over Chan et al. and Jang I et al.

Applicants respectfully submit that independent claim 10 is patentable over Chan et al. and Jang I et al. because, for instance, they do not teach or suggest forming a trench structure disposed between islands in the semiconductor substrate, the islands having formed thereon the silicon nitride layer and the first oxide layer; and forming a second oxide layer on a bottom and sidewalls of the trench and on a surface of the first oxide layer on the islands. Moreover, they do not teach or suggest forming a conductive layer over the silicon nitride layer on the semiconductor substrate and the trench; and removing the conductive layer on the silicon nitride layer.

As discussed above, Chan et al. specifically discloses that "an oxide layer 21 is then selectively deposited on the silicon exposed in the bottom of trench 19 rather than on the barrier layer 30" (col. 3, lines 11-13), so that the oxide layer 21 is deposited on the silicon at the bottom of the trench 19 only and not formed on the barrier layer 30 of the islands. Therefore, Chan et al. clearly teaches away from the claimed feature of forming a second oxide layer on the surface of the first oxide layer on the islands. Chan et al. and Jang I et al. disclose different processes and teach away from one another.

Moreover, the conductive material in Chan et al. is not formed over the silicon nitride layer on the semiconductor substrate, because the silicon nitride has been removed (see Figs. 3E and 4).

For at least the foregoing reasons, claim 10 and claims 11, 12, and 16-19 depending therefrom are patentable over Chan et al. and Jang I et al.

Claims 3, 4, 13, and 14

Dependent claims 3, 4, 13, and 14 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Chan et al. and Jang I et al. as applied to claims 1 and 10, and further in view of Jang II et al. (US 5,741,740). The Examiner recognizes that Chan et al. does not disclose using the silicon nitride layer as an etch stop layer for a chemical mechanical polishing (CMP) method, but cites Jang II et al. for using an oxide/nitride mask for a CMP method when forming a filled trench.

As an initial matter, Applicants note that Jang II et al. does not cure the deficiencies of Chan et al. and Jang I et al., since Chan et al. specifically discloses that "an oxide layer 21 is then selectively deposited on the silicon exposed in the bottom of trench 19 rather than on the barrier layer 30" (col. 3, lines 11-13), so that the oxide layer 21 is deposited on the silicon at the bottom of the trench 19 only and not formed on the barrier layer 30 of the islands. Therefore, Chan et al. clearly teaches away from the claimed feature of forming a second oxide layer on the surface of the first oxide layer on the islands in claims 1 and 10, and there is no motivation to combine the different processes disclosed in Chan et al., Jang I et al., and Jang II et al.

Furthermore, nothing in Chan et al. suggests the use CMP to remove the barrier layer 30 and the oxide layer 21. The oxide layer 21 is removed by a buffered oxide etch, and the barrier layer 30 is removed by a wet nitride etch (col. 3, lines 18-21). Indeed, in the embodiment shown and described, the barrier layer 30 is a nitride layer (col. 3, lines 1-3 and 18-21). There is no motivation to use CMP to remove the nitride barrier layer 30.

For at least the foregoing reasons, claims 3, 4, 13, and 14 are patentable over Chan et al., Jang I et al., and Jang II et al.

Claims 5 and 15

Claims 5 and 15 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Chan et al. and Jang I et al. as applied to claims 1 and 10 above, and further in view of Hshieh et al. (US 6,674,124). The Examiner acknowledges that Chan et al. discloses a subatmospheric chemical vapor deposition (SACVD), but cites Hsieh et al. for teaching a plasma-enhanced CVD (PECVD) method for depositing the oxide filling layer in a trench MOSFET.

Applicants note that Hshieh et al. does not cure the deficiencies of Chan et al. and Jang I et al., since Chan et al. specifically discloses that "an oxide layer 21 is then selectively deposited on the silicon exposed in the bottom of trench 19 rather than on the barrier layer 30" (col. 3, lines 11-13), so that the oxide layer 21 is deposited on the silicon at the bottom of the trench 19 only and not formed on the barrier layer 30 of the islands. Therefore, Chan et al.

clearly teaches away from the claimed feature of forming a second oxide layer on the surface of the first oxide layer on the islands in claims 1 and 10, and there is no motivation to combine the different processes disclosed in Chan et al., Jang I et al., and Hshieh et al.

For at least the foregoing reasons, claims 5 and 15 are patentable over Chan et al., Jang I et al., and Hshieh et al.

Claim 21

Claim 21 depends from claim 20, and stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Chan et al. in view of Hshieh et al. The Examiner alleges that it would have been obvious to use the PECVD method of Hshieh et al. in the method of Chan et al.

Applicants note that Hsieh et al. does not cure the defects of Chan et al., since Chan et al. specifically discloses that "an oxide layer 21 is then selectively deposited on the silicon exposed in the bottom of trench 19 rather than on the barrier layer 30" (col. 3, lines 11-13), so that the oxide layer 21 is deposited on the silicon at the bottom of the trench 19 only and not formed on the barrier layer 30 of the islands. Therefore, Chan et al. clearly teaches away from the claimed feature of forming a second oxide layer over the first oxide layer of the islands in claim 20, and there is no motivation to combine the different processes disclosed in Chan et al. and Hshieh et al.

For at least the foregoing reasons, claim 21 is patentable over Chan et al. and Hshieh et al.

Claim 22

Claims 22 depends from claim 20, and stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Chan et al. in view of Jang II et al. The Examiner alleges that it would have been obvious to use CMP in Chan et al. to remove the barrier layer 30 and the oxide layer 21.

As an initial matter, Applicants note that Jang II et al. does not cure the deficiencies of Chan et al., since Chan et al. specifically discloses that "an oxide layer 21 is then selectively deposited on the silicon exposed in the bottom of trench 19 rather than on the barrier layer 30" (col. 3, lines 11-13), so that the oxide layer 21 is deposited on the silicon at the bottom of the trench 19 only and not formed on the barrier layer 30 of the islands. Therefore, Chan et al. clearly teaches away from the claimed feature of forming a second oxide layer over the first oxide layer of the islands in claim 20, and there is no motivation to combine the different processes disclosed in Chan et al. and Jang II et al.

Moreover, nothing in Chan et al. suggests the use CMP to remove the barrier layer 30 and the oxide layer 21. The oxide layer 21 is removed by a buffered oxide etch, and the barrier layer 30 is removed by a wet nitride etch (col. 3, lines 18-21). Indeed, in the embodiment shown and described, the barrier layer 30 is a nitride layer (col. 3, lines 1-3 and 18-21). There is no motivation to use CMP to remove the nitride barrier layer 30.

For at least the foregoing reasons, claim 22 is patentable over Chan et al. and Jang II et al.

CONCLUSION

In view of the foregoing, Applicants believe all claims now pending in this Application are in condition for allowance. The issuance of a formal Notice of Allowance at an early date is respectfully requested.

If the Examiner believes a telephone conference would expedite prosecution of this application, please telephone the undersigned at 650-326-2400.

Respectfully submitted,

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